CORPORATE FORECASTING

AN ECONOMETRIC MODEL OF THE EDMONTON ECONOMY

Jong Huang

Research Paper No. 14

THE CITY OF Edmonton PLANNING AND BUILDING

Research Paper No. 14

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by

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IMPORTANT NOTE

This Technical Paper has been prepared by the Corporate Forecasting Group, Long Range Planning Branch, Planning and Building Department. The Paper documents research results as part of an ongoing forecasting activity. Neither the methods nor the results have been endorsed by the City of Edmonton.

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AN ECONOMETRIC MODEL OF THE EDMONTON ECONOMY

I. INTRODUCTION

The 1970's were a time of unprecedented growth for the City of Edmonton, as its' population increased by 85,000 from 436,000 persons in 1971 to 521,888 persons in 1981. This resulted in increased pressures on product markets and municipal services, thus causing municipal operating expenditures to rise from $90 million in 1972 to $364 million in 1981, at an average annual growth rate of 16.8%. With the introduction of the National Energy Program and the fall of world oil prices in 1981-82, economic activity slowed down in Alberta and Edmonton. Jobs were lost in most of the sectors, resulting in a drastic increase in unemployment rates. The unemployed responded by migrating to other parts of Canada in search of employment, thus moderating the demand for City services.

With stable oil prices in 1983, growth returned to the provincial economy in 1985. However, this was short lived as world oil prices collapsed in the first half of 1986.

Each phase of the economic cycle resulted in a different set of questions for the City's decision makers. These ranged from the adequacy of municipal services to the size of the City's economic base and municipal revenues. Effective solutions to these issues requires an understanding of the current and future economic structure and external environment. Knowledge of the interrelationships among various interacting variables in the Edmonton economic system and the ability to evaluate the impact of external environmental changes on the Edmonton economy can be acquired by a structural analysis of the economy. This leads to the need for the development of an econometric model for the Edmonton economy.

The Edmonton econometric model was prepared to meet the following objectives:

1) to develop a scientific tool based on sound economic and econometric theories for future economic forecasting and impact assessment;

2) to prepare consistent and integrated short and medium-term forecasts of the Edmonton economy for use in the preparation of the City's 5-year budget estimates and the City's annual budget; and

3) to assess the impact on the Edmonton economy of major changes in government policies and other external economic factors such as world oil prices, interest rate, Canadian and American economic conditions

The Edmonton econometric model is an annual model designed for short and medium-term forecasting and simulation. The model consists of approximately 82 equations, of these 50 are stochastic (or structural) equations and the rest are definitional (or identity) equations. The stochastic equations were estimated and tested using the Ordinary Least Squares method and, when necessary, the Cochrane-Orcutt method. The annual data used for fitting the equations cover the period 1971 to 1985, except for the migration equations which were fitted to the 1975 to 1985 data.

In Section II, the structure of the model and the interrelationships among various blocks of the model are discussed. Specifications of the equations in each block and the theories behind the specifications are discussed in the Corporate Forecasting Group's Research Papers Nos. 1 to 4 and Nos. 7 to 10. The estimated model is presented by blocks in Section III and simulation of the model based on different sets of assumptions on world oil prices and other external factors is shown in Section IV.

Several individuals were involved in the development and estimation of the model under the direction of Jong Huang, Senior Economist of the Corporate Forecasting Group, Long Range Planning Branch, Planning and Building Department. Patrick Walters was responsible for developing a method for estimating data for Edmonton's Gross Domestic Product by major industry divisions for the period 1971 to 1985. Patrick Walters and Tim Ford developed and estimated the equations for output, employment and wages by industry divisions (see Research Paper No. 7). Jong Huang and Robert Higgins developed and estimated the equations for the housing market (see Research Papers Nos. 2 and 10). Jong Huang and Tim Ford were responsible for the

equations for downtown office space market and building permits (see Research Paper Nos. 4 and 8). Jong Huang and Angela Hingston estimated the retail sales equations. Jong Huang also developed and estimated the equations for Alberta's Gross Domestic Product, employment and migration, and for Edmonton's migration, labour market, wages and prices (see Research Paper Nos. 1, 3 and 9). The integration of the various sub-models and computer simulation of the model were performed by Jong Huang and Patrick Walters, using the Econometric Software Package (ESP) marketed by ECONOMICA, Inc. of Massachusetts. Chris Yap assisted in data collection and estimation of some equations. Throughout the development of the model, Harvey Crone, Director of the Corporate Forecasting Group, provided continued support and encouragement.

II. STRUCTURE OF THE MODEL

The Edmonton model is a simultaneous econometric model rather than an economic base model or an input-output model. The simultaneous type of regional or metropolitan econometric model was pioneered by L. R. Klein (1969) and refined by N. Glickman (1971, 1977) for Philidelphia, by B. M. Rubin and R. A. Erickson (1977, 1980, 1981) for the Milwaukie Metropolitan Area, and by S. F Duobinis (1981) for the Chicago Metropolitan Area. (See Research Paper No. 7 for a brief discussion).

As shown in the "Flow Chart", the model consists of the following nine blocks:

1. Alberta and Canadian Economic Activity
2. Alberta Demography and Labour Market
3. Edmonton Demography and Labour Market
4. Edmonton Industrial Activity
5. Income, Wages and Prices
6. Edmonton Housing Market
7. Edmonton Downtown Office Space Market
8. Edmonton Construction Sector
9. Edmonton Retail Market

The nine blocks are inherently inter-related to each other. Within each block, there are numerous equations describing the causal relationships among various economic factors. The arrows on the flow chart show the direction of the causal relationships among the blocks.

The model is linked to the Alberta and Canadian economies so that impacts on the local economy of changes in the provincial and national economy can be evaluated. The world oil price is also included in the model to assess the response of local economic activities to oil price changes. The other external factors included in the model are government policies such as the National Energy Program and interest rates.

Equations in a model may have one of the three types of relationships among variables: simple recursive equations, dependent recursive equations and

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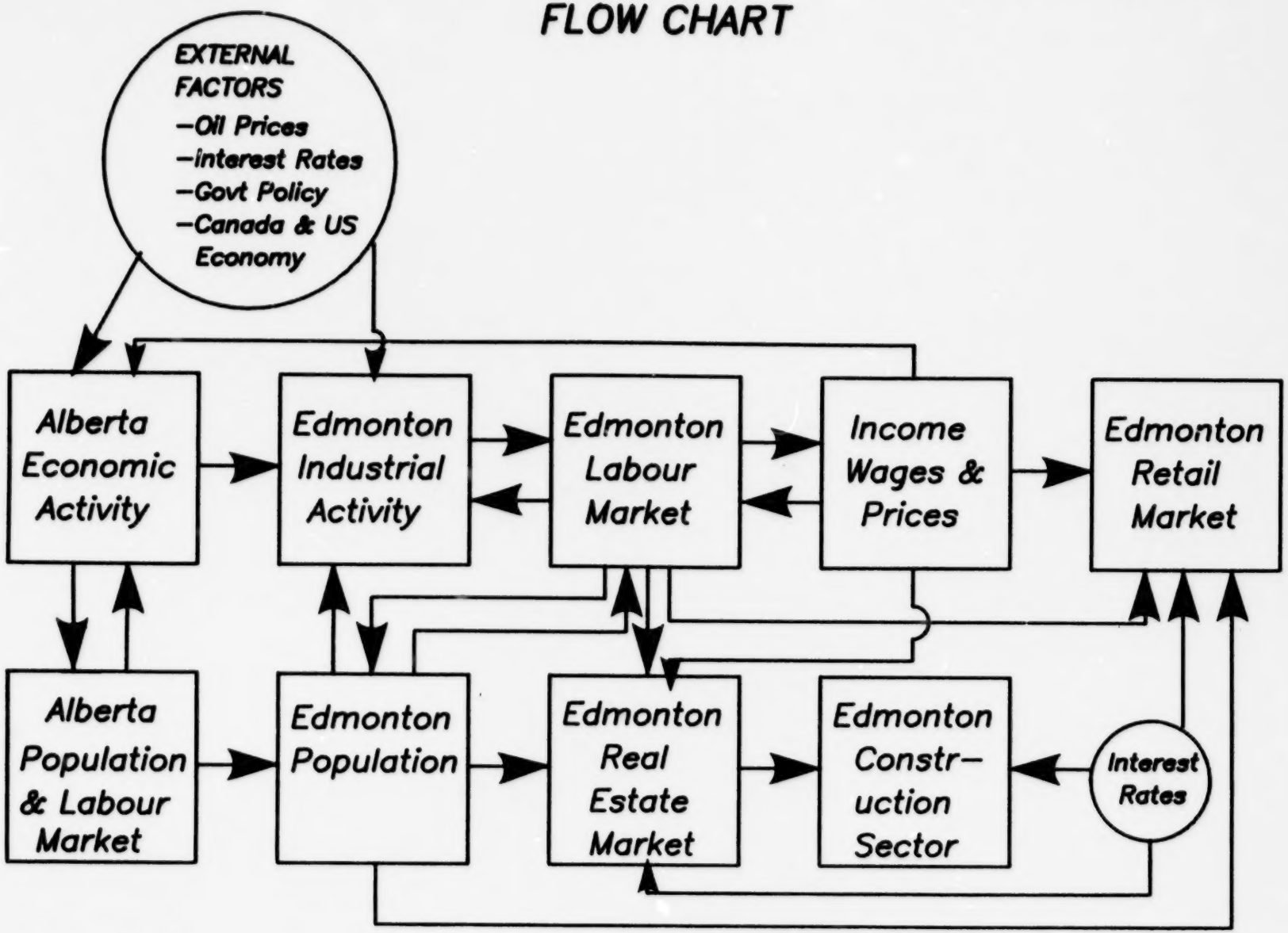
FLOW CHART



simultaneous equations. Both the simple and dependent recursive equations have a causal relationship among variables flowing in only one direction, while the simultaneous equations have a causal relationship among variables flowing in more than one direction. The value of a dependent variable in the simple recursive equations can be determined independently of the current values of other dependent variables in the model; the value of a dependent variable in the dependent recursive equations can only be solved after the current values of other dependent variables in the model are obtained; however, the value of a dependent variable in the simultaneous equations can only be determined simultaneously with values of other dependent variables in the simultaneous system.

The Edmonton Econometric Model consists of all of the three types of equations. The simple recursive equations include equations for Canadian gross national product, single housing starts, single housing completions, productivity in the manufacturing sector, productivity in the finance sector, productivity in the transportation sector and productivity in the construction sector. The simultaneous equations include equations for consumer price index, consumer price growth rate, real prime rate, weekly wage earnings, Canadian industrial selling price index, Alberta's gross domestic product implicit price index, Alberta's real gross domestic product, Alberta's GDP growth rate, Alberta's net migration, Alberta's labor force participation rate, Alberta's population, Edmonton CMA population, Edmonton CMA working age population, Edmonton labor force participation rate, Edmonton labour force, Alberta's working age population, Albert's labour force, Alberta's employment and Edmonton's employment. The remainder of equations are the dependent recursive equations.

III. ESTIMATION OF THE MODEL

The structural equations in the Edmonton Econometric Model were estimated using the Ordinary Least Squares method and, when necessary, the Cochrane-Orcult method. The estimated model is presented below. A list of variables used in the model are shown in Appendix I.

1. Alberta and Canadian Economic Activity

GDP=-150+.0765*TIME-.6026*NEP+7.16*WOP/GDPIP-.0479*RIR+.0109*EMPA
GDPR=(GDP-GDP(-1))/GDP(-1)*100
GNP=(1+RGNP/100)*GNP(-1)

2. Alberta Demography and Labour Market

POPA=(1+12/1000)*POPA(-1)+MIGNA
MIGNA=-3.165+.7547*MIGNA(-1)+4.435*GDPR
MIGINA=96.101-155.31*URA/URC+.112*EMPA+3.475*GDPR
MIGOTA=MIGINA-MIGNA
WAPA=-387.056+.9201*POPA-2.8969*URA(-1)
PRA=109.16+.92*GDP-1.17*FWAP+.1504*URA(-1)+5.00E-4*RPY(-1)
LFA=PRA*WAPA/100
EMPA=-133+.2713*EMPA(-1)+29.232*GDP+.746*LFA-.887*WR
URA=(LFA-EMPA)/LFA*100

3. Edmonton Demography and Labour Market

POPE=338+6.52E-5*SQ(POPA)
MIGNE=-19.8+.158*MIGNA+.056*EMPE
MIGINE=-9.8+.122*MIGINA+.075*EMPE+.384*GDPR
MIGOTE=MIGINE-MIGNE
WAP=-3228+578.239*LOG(POPE)
PR=44.47+.9*GDP-.1082*UR(-1)+.0012*RPY(-1)
LF=PR*WAP/100
EMPE=-65+.22*EMPE(-1)+8.5*GDP-.3923*WR+.9772*LF
UR=100*(LF-EMPE)/LF

4. Edmonton Industrial Activity

CONST=32.677+.36753*CONST(-1)+.42117*BPTR(-1)+.033199*NCEP
F=-325.83+1.115*POPE+.013*NCEP
M=237.82-34.061*WR/WRC+.051185*NCEP
S=-419.05+.46*POPA+.69*NCEP
T=191.369+.013*POPA+.01*NCEP
TT=-597.37+.8*M+.46*POPA
NCEP=349.827+.64154*NCEP(-1)+108.846*WOP/GDPIP
TOUT=M+T+F+S+TT+CONST
TOUTR=(TOUT/TOUT(-1)-1)*100
CE=5.5578-.044*PRDC+.028*CONST
FE=13.6921-.3708*PRDF+.0272*F
ME=10.29-.02855*PRDM+.0366*M
SE=-5592.12+2.85*TIME+.041*S
TE=-2329.5+.023418*T+1.1948*TIME
TTE=8.2703-.098062*PRDTT+.029*TT
TEMP=ME+TE+FE+SE+TTE+CE
PRDC=CONST(-1)/CE(-1)
PRDF=F(-1)/FE(-1)
PRDM=M(-2)/ME(-1)
PRDTT=TT(-2)/TTE(-1)
WC=-30.9032+7.5642*CPI(-1)-21.3623*UR
WF=-31.57+4.3*CPI(-1)-2.97*UR
WM=-41.332+1.7821*WCM-9.9837*UR
WS=-54.489+1.6281*WCS-1.4075*UR
WT=2.03+3.33*CPI(-1)-4.93*UR
WTT=-37.89+5.57*CPI(-1)-3.99*UR

5. Income, Wages and Prices

RPY=548+.9624*RPY(-1)+49.7817*GDPR
RPDY=294+.3111+RPY
RPYR=(RPY/RPY(-1)-1)*100
CPI=5.2+.02*EMPE+.1721*WR(-1)+.1339*ISP(-1)
CPIR=(CPI-CPI(-1))/CPI(-1)*100

```
RIR=IR-CPIR
GDPIP=-42.44+.6225*ISP+.8994*ISP(-1)
ISP=-26.27+.3919*GNP+.6772*WR
ISPR=(ISP/ISP(-1)-1)*100
NHP=13+.5029*WR-7.7767*UR-1.9861*IR
NHPR=(NHP/NHP(-1)-1)*100
RNH=NHP/NHP(-1)/(CPI/CPI(-1))*RNH(-1)
WR=-17-3.2065*UR(-1)+3.87*CPI
WRR=(WR/WR(-1)-1)*100
```

6. Edmonton Housing Market

```
TS=1665-418.189*(RIR+1.5)-397.282*APTVR(-1)+62.0839*RNH(-2)
TC=160+.366*TS+.6539*TS(-1)
TA=378+.78682*TC+.11339*(POPE(-1)-POPE(-2))
SS=1019-226.738*(RIR(-1)+1.5)+28.2166*RNH(-2)-.673408*SI(-1)
SC=-160+.52455*SS+.624*SS(-1)
SA=430+.768*SC+.03054*(POPE-POPE(-1))
SI=SI(-1)+SC-SA
MS=TS-SS
MC=TC-SC
MA=TA-SA
APTVR=-4.4+.45713*UR+4.90E-4*MC(-1)+.51634*APTVR(-1)
```

7. Edmonton Downtown Office Space Market

```
NC=-845-71.78*VR(-2)-.608*NC(-1)+8.392*EMPE
TSO=TSO(-1)+NC
ABSOF=-325+2.807*EMPE-992.45*NEP+.217*NC(-1)-.311*ABSOF(-1)
TO=TO(-1)+ABSOF
VS=TSO-TO
VR=.3374+.93*VR(-1)+.0079*NC-.0075*ABSOF
```

8. Edmonton Construction Sector

```
BPTR=657.9+29.5031*MIGNE+18.8542*MIGNE(-1)-16.2623*(RIR+1.5)
```

BPT=BPTR*CPI/100

9. Edmonton Retail Market

RSALE81=-2910-84.5848*IR-19.7207*CPI+1.7604*RPDY+8.5102*EMPE
RSALE=RSALE81*CPI/100

IV. SIMULATION OF THE MODEL

The estimated model presented in the previous section was used to simulate the impact of different oil prices on the Alberta and Edmonton economies, using the Econometric Software Package (ESP). This section presents the assumptions used in the simulation and the simulated results.

1. Assumptions Used in Model Simulation

Two different assumptions are made for the world oil prices and one common assumption are used for other exogenous variables such as interest rate, Canada's economic growth rate, unemployment rate and wage rates in various industry sectors. The lower oil price assumption is called the "base case" while the higher oil price assumption is called the "City Forecast Committee case" as it was used by the Committee in their "Socio-Economic Forecasts 1986-1991" Report (June, 1986). The assumptions are listed in Appendix II.

2. Simulated Results

The simulated results for the base case are shown in Appendix III and those for the City Forecast Committee case are displayed in Appendix IV. Comparison of two simulated results is shown in Appendix V. The simulated values for some of the major variables in the model are worthy mentioning below.

Under the base case, Alberta's economy declines by about 1% in 1986 and returns to positive growth of 1.3% in 1987. The growth rate increases gradually and reaches 3.8% in 1991. Edmonton's unemployment rate remains in the 12%-14% range, even though total employment in Edmonton continues to rise from 354,000 in 1986 to 386,000 in 1991. The persistent high unemployment results because Edmonton's labour force increases faster than employment. The increase of consumer prices in Edmonton will remain below 3.5% and the increase of weekly wage earnings will stay below 3.8% over the forecast period. The apartment vacancy rate will be in the 4% range and the downtown office space vacancy rate will remain above 15% during the same period. Housing starts will stay in the range of 2,000 to 2,800 units for the period.

Under the City Forecast Committee scenario, Alberta's economy will perform slightly better with only 0.6% reduction in total output in 1986. The economy will return to positive growth of 2.2% in 1987 and will thereafter continue to rise at a rate of 2.6% to 4.5% for the period 1988-1991. Edmonton's unemployment rate will remain at 12% to 13% although employment in Edmonton will rise from 355,000 in 1986 to 407,000 in 1991. The increase of consumer prices in Edmonton will be at 3%-4% and wage increases will be at 3.5%-4.5% per year over the forecast period. As in the base case, the apartment vacancy rate will be in the 4% range and the downtown office space vacancy rate will remain above 15% during the same period. Housing starts will be in the range of 2,000 to 3,500 units for the period.

V. CONCLUSIONS AND RECOMMENDATIONS

The Edmonton Econometric Model described in the previous sections has met the objectives set out for the project. Most importantly, the model enables users to evaluate the impact of changes in world oil prices and other external factors on the Alberta and Edmonton economies. Although there is a need for future enhancements, this model will be used by the Corporate Forecasting Group of the City Planning and Building Department in their task of preparing five year economic forecasts to assist the City's annual budget and planning preparation.

It is recommended that this model be updated and refined annually to utilize newly available data in order to reflect possible structural changes in the economy and to incorporate in the model new policy variables such as Federal and Alberta's oil and gas royalty taxes and incentives. Furthermore, it is recommended that this model be expanded to incorporate the existing City's population projection model when the more powerful PC Computer (386 series) becomes available. In the near future, the following areas require enhancement in order to improve the forecasting ability of the model in the areas.

(1) Housing starts for multiple family housing;
(2) Net migration for Alberta;
(3) Downtown office space absorption; and
(4) Building Permits.

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APPENDICES

APPENDIX I

LIST OF VARIABLES USED IN EDMONTON ECONOMETRIC MODEL

I. EXOGENOUS VARIABLES

FWAP - Percent of working age population accounted for by female
IR - Prime rate, in percent
NEP - National Energy Program
RGNP - Canada's gross national product growth rate, in percent
TIME - Year used as a proxy for time trend
URC - Canada's unemployment rate, in percent
WCM - Weekly wage earnings in Canadian manufacturing industries, in dollars
WCS - Weekly wage earnings in Canadian service industries, in dollars
WOP - World oil price in US dollars per barrel
WRC - Canadian weekly wage earnings, all industries, in dollars

II. ENDOGENOUS VARIABLES

ABSOF - Office space absorption, in thousands of square feet
APTVR - Apartment vacancy rate, in percent
BPT - Building permit values, in millions of dollars
BPTR - Building permit values, in millions of 1981 dollars
CE - Construction employment, in thousands of persons
CONST - Construction output, in millions of 1971 dollars
CPI - Edmonton consumer price index (1981=100)
CPIR - Edmonton inflation rate, in percent
EMPA - Alberta employment, in thousands of persons
EMPE - Edmonton employment, in thousands of persons
F - Finance sector output, in millions of 1971 dollars.
FE - Finance sector employment, in thousands of persons
GDP - Alberta gross domestic product, in billions of 1971 dollars
GDPIP - Alberta gross domestic product implicit price index (1971=100)
GDPR - Alberta gross domestic product growth rate, in percent
GNP - Gross national product, in billions of 1971 dollars
ISP - Canada industrial selling price index (1971=100)
ISPR - Canada industrial selling price growth rate, in percent

LF - Edmonton labour force, in thousands of persons

LFA - Alberta labour force, in thousands of persons

M - Manufacturing sector output, in millions of 1971 dollars

MA - Multiple housing absorption

MC - Multiple housing completions

ME - Manufacturing sector employment, in thousands of persons

MIGINA - Alberta total in-migration, in thousands of persons

MIGINE - Edmonton total in-migration, in thousands of persons

MIGNA - Alberta net migration, in thousands of persons

MIGNE - Edmonton net migration, in thousands of persons

MIGOTA - Alberta total out-migration, in thousands of persons

MIGOTE - Edmonton total out-migration, in thousands of persons

MS - Multiple housing starts

NC - New office space construction, in thousands of square feet

NCEP - Alberta's net capital expenditures in the oil industry, in millions of dollars

NHP - New house price index (1971=100)

NHPR - New house price growth rate, in percent

POPA - Alberta population, in thousands of persons

POPE - Metro-Edmonton population, in thousands of persons

PR - Edmonton participation rate, in percent.

PRA - Alberta participation rate, in percent

PRDC - Construction sector productivity, thousands of dollars output per employee

PRDF - Finance sector productivity, thousands of dollars output per employee

PRDM - Manufacturing sector productivity, thousands of dollars output per employee

PRDTT - Transportation sector productivity, thousands of dollars output per employee

RIR - Real prime rate, in percent

RNH - Real new house price index (1971=100)

RPDY - Alberta's personal disposable income per capita, in 1971 dollars

RPY - Alberta's personal income per capita, in dollars

RPYR - Alberta's personal income growth rate, in percent

RSALE - Edmonton retail sales, in thousands of dollars

RSALE81 - Edmonton retail sales, in thousands of 1981 dollars
S - Service sector output, in millions of 1971 dollars
SA - Single family housing absorption
SC - Single family housing completions
SE - Service sector employment, in thousands of persons
SI - Single family housing inventory
SS - Single family housing starts
T - Trade sector output, in millions of 1971 dollars
TA - Total housing absorption
TC - Total housing completions
TE - Trade sector employment, in thousands of persons
TEMP - Total employment, six industry sectors, in thousands of persons
TO - Total office space, in thousands of square feet
TOUT - Total output, six industry sectors, in millions of 1971 dollars
TS - Total housing starts
TSO - Total occupied office space, in thousands of square feet
TT - Transportation sectors output, in millions of 1971 dollars
TTE - Transportation sectors employment, in thousands of persons
UR - Edmonton unemployment rate, in percent
URA - Alberta unemployment rate, in percent
VR - Office vacancy rate, in percent
VS - Vacant office space, in thousands of square feet
WAP - Edmonton working age population, in thousands of persons
WAPA - Alberta working age population, in thousands of persons
WC - Edmonton weekly wage earnings in construction sector, in dollars
WF - Edmonton weekly wage earnings in finance sector, in dollars
WM - Edmonton weekly wage earnings in manufacturing sector, in dollars
WR - Edmonton weekly wage earnings, all industries, in dollars
WRR - Edmonton weekly wage growth rate, all industries, in percent
WS - Edmonton weekly wage earnings in service sector, in dollars
WT - Edmonton weekly wage earnings in trade sector, in dollars
WTT - Edmonton weekly wage earnings in transportation sector, in dollars

APPENDIX II

ASSUMPTIONS USED IN MODEL SIMULATION

	World Oil Prices				
	Base Case	City Committee	Prime Rate	Canada's GNP Growth	Canada's Unemployment Rate
	(US $/barrel)		(%)	(%)	(%)
1986	15.0	16.0	10.50	3.0	9.8
1987	15.5	19.0	10.00	2.5	9.6
1988	16.1	22.0	10.00	2.0	9.4
1989	16.8	24.0	9.75	2.5	9.2
1990	17.5	26.0	9.75	2.6	9.0
1991	18.4	27.0	9.50	3.0	9.0

	% Female Age 15+ (%)	Canada's Weekly Wage ($)	Canada's Wage - Services ($)	Canada's Wage - Manufacturing ($)
1986	49.8	462.3	267.96	412.42
1987	49.9	475.2	279.42	423.93
1988	49.9	495.4	287.22	441.94
1989	49.9	518.6	300.66	462.62
1990	50.0	541.8	314.10	383.20
1991	50.0	567.0	328.71	505.67

APPENDIX III
SIMULATED RESULTS - BASE CASE

ID	ABSOF :S	APTVR :S	BPT :S	BPTR :S	CE :S
1986	611.541	4.29817	537.644	419.418	12.9669
1987	548.370	3.78038	596.751	450.995	15.2745
1988	607.459	4.00119	686.969	501.838	16.0755
1989	639.534	4.48580	787.392	557.878	16.7764
1990	664.115	4.80109	908.750	625.917	17.5653
1991	712.861	4.63311	1101.36	736.713	18.5684

ID	CONST :S	CPI :S	CPIR :S	EMPA :S	EMPE :S
1986	308.854	128.188	3.12791	1144.83	354.240
1987	384.455	132.318	3.22239	1152.50	355.310
1988	415.186	136.890	3.45512	1164.07	357.521
1989	441.252	141.140	3.10498	1185.18	362.975
1990	470.173	145.186	2.86664	1213.63	371.699
1991	506.728	149.497	2.96880	1259.05	385.825

ID	F :S	FE :S	GDP :S	GDPIP :S	GDPR :S
1986	487.630	14.8428	14.2918	450.618	-.916556
1987	488.475	14.7967	14.4787	488.875	1.30811
1988	493.576	14.8764	14.6928	487.377	1.47836
1989	502.677	15.0623	14.9964	504.533	2.06891
1990	515.501	15.3390	15.3718	521.528	2.50276
1991	533.443	15.7402	15.9625	540.010	3.84307

ID	GNP :S	ISP :S	ISPR :S	LF :S	LFA :S
1986	150.873	330.803	3.61904	402.762	1267.60
1987	154.646	343.439	3.81956	407.665	1282.21
1988	157.738	354.905	3.33875	413.905	1304.54
1989	161.681	365.897	3.09718	421.948	1333.33
1990	165.723	377.317	3.12100	432.212	1366.35
1991	170.695	390.508	3.49598	446.229	1413.48

ID	M :S	MA :S	MC :S	ME :S	MIGINA :S
1986	325.291	130.227	184.230	21.7524	67.6389
1987	300.105	339.400	453.227	20.8276	66.0640
1988	284.434	673.929	879.578	20.2543	53.6952
1989	274.727	763.794	989.262	19.9220	48.4529
1990	268.612	573.105	747.155	19.7135	47.8482
1991	264.801	441.463	581.675	19.5838	61.9370

ID	MIGINE :S	MIGNA :S	MIGNE :S	MS :S	NC :S
1986	24.6680	-13.5694	-2.10651	119.238	305.088
1987	25.4104	-7.60432	-1.10411	682.099	458.244
1988	24.1326	-2.34744	-.149675	970.575	620.198
1989	24.1280	4.23013	1.19496	755.363	666.593
1990	24.8759	11.1272	2.77326	432.893	743.733
1991	28.1689	22.2787	5.32594	543.888	838.221

ID	NCEP :S	NHP :S	NHPR :S	POPA :S	POPE :S
1986	2342.22	119.717	7.36970	2363.61	702.252
1987	1856.05	122.810	2.58374	2384.37	708.678
1988	1544.15	124.363	1.26449	2410.64	716.890
1989	1344.08	129.124	3.82836	2443.80	727.385
1990	1215.76	136.235	5.50744	2484.25	740.382
1991	1133.49	148.690	9.14186	2536.34	757.433

ID	PR :S	PRA :S	PRDC :S	PRDF :S	PRDM :S
1986	71.6725	72.0865	28.1538	32.6666	15.5252
1987	71.8713	72.0850	23.8185	32.8528	15.6304
1988	72.1243	72.4077	25.1697	33.0122	15.6182
1989	72.4644	72.8481	25.8271	33.1784	14.8168
1990	72.9444	73.2031	26.3018	33.3730	14.2773
1991	73.6732	73.8398	26.7670	33.6072	13.9359

ID	PRDTT :S	RIR :S	RNH :S	RPDY :S	RPY :S
1986	27.7154	7.37208	96.5128	4357.49	13061.6
1987	28.4184	6.77760	95.9157	4395.44	13183.6
1988	27.8548	6.54487	93.8847	4434.61	13309.5
1989	27.4184	6.64501	94.5434	4481.41	13460.0
1990	27.1400	6.88335	96.9705	4533.21	13626.5
1991	26.9936	6.53119	102.784	4603.82	13853.4

ID	RPYR :S	RSALE :S	RSALE81 :S	S :S	SA :S
1986	.089596	5621.85	4385.63	829.828	1945.54
1987	.934036	5851.94	4422.61	805.831	1810.56
1988	.954881	6051.18	4420.45	796.392	1792.49
1989	1.13041	6332.80	4486.86	797.840	1932.53
1990	1.23695	6639.12	4572.81	807.594	1917.27
1991	1.66556	7106.93	4753.89	825.878	1852.10

ID	SC :S	SE :S	SI :S	SS :S	T :S
1986	1972.96	102.002	80.4135	1817.93	245.518
1987	1797.35	103.868	67.2036	1568.88	240.926
1988	1773.75	106.331	48.4633	1820.16	238.148
1989	1956.00	109.241	71.9367	1868.70	236.579
1990	1936.03	112.491	90.6998	1772.88	235.822
1991	1851.01	116.090	89.6149	1724.79	235.676

ID	TA :S	TC :S	TE :S	TEMP :S	TO :S
1986	2075.77	2157.19	49.1223	227.993	11209.8
1987	2149.96	2250.58	50.2096	231.907	11758.2
1988	2466.42	2653.33	51.3394	235.849	12365.7
1989	2696.32	2945.27	52.4974	240.731	13005.2
1990	2490.37	2683.19	53.6745	246.440	13669.3
1991	2293.56	2432.69	54.8659	253.126	14382.2

ID	TOUT :S	TOUTR :S	TS :S	TSO :S	TT :S
1986	2947.24	-.430768	1937.17	13890.0	750.127
1987	2959.32	.409677	2250.98	14148.2	739.528
1988	2966.81	.253023	2790.73	14768.4	739.072
1989	2999.63	1.10647	2624.06	15435.0	746.560
1990	3057.98	1.94497	2205.77	16178.8	760.276
1991	3147.71	2.93448	2268.67	17015.0	781.188

ID	TTE :S	UR :S	URA :S	VR :S	VS :S
1986	27.3061	12.0473	9.68566	17.5050	2480.16
1987	26.9298	12.8427	10.1163	16.1244	2390.03
1988	26.9719	13.6222	10.7683	15.6767	2402.77
1989	27.2318	13.9759	11.1110	15.3863	2429.83
1990	27.6569	14.0007	11.1769	15.5413	2509.45
1991	28.2777	13.5366	10.9252	16.0505	2632.81

ID	WAP :S	WAPA :S	WC :S	WF :S	WM :S
1986	561.947	1758.45	651.967	467.139	573.364
1987	567.215	1778.75	664.386	481.495	585.935
1988	573.876	1801.67	678.979	496.942	610.254
1989	582.280	1830.29	706.005	515.550	643.580
1990	592.522	1866.51	737.627	533.753	679.996
1991	605.687	1914.25	778.145	552.530	724.671

ID	WR :S	WRR :S	WS :S	WT :S	WTT :S
1986	439.968	3.50246	364.813	356.555	606.392
1987	456.443	3.74465	382.365	365.581	624.874
1988	471.586	3.31748	393.960	375.493	644.772
1989	485.535	2.95800	415.347	388.973	668.826
1990	500.059	2.99131	437.192	403.005	692.402
1991	516.661	3.31991	461.626	418.766	716.790

APPENDIX IV
SIMULATED RESULTS - CITY FORECAST COMMITTEE CASE

ID	ABSOF :S	APTVR :S	BPT :S	BPTR :S	CE :S
1986	613.659	4.25629	547.110	426.753	12.9671
1987	558.579	3.58675	641.173	484.262	15.3620
1988	630.873	3.55955	789.174	575.185	16.4991
1989	676.596	3.79832	953.422	671.324	17.7892
1990	714.207	3.95908	1139.29	774.681	19.2582
1991	773.054	3.82679	1381.98	904.799	20.9209

ID	CONST :S	CPI :S	CPIR :S	EMPA :S	EMPE :S
1986	308.862	128.203	3.13999	1147.10	354.994
1987	387.579	132.402	3.27525	1162.47	358.692
1988	430.409	137.203	3.62647	1186.11	365.097
1989	477.829	142.021	3.51130	1220.74	375.200
1990	531.512	147.066	3.55219	1263.66	388.718
1991	592.054	152.739	3.85743	1321.02	406.597

ID	F :S	FE :S	GDP :S	GDPIP :S	GDPR :S
1986	488.067	14.8547	14.3329	450.643	-.631584
1987	490.589	14.8531	14.6438	469.170	2.16988
1988	498.791	15.0119	15.0264	488.775	2.61266
1989	512.104	15.3010	15.5009	508.479	3.15751
1990	530.137	15.7016	16.0600	529.631	3.60699
1991	553.501	16.2279	16.7849	553.625	4.51360

ID	GNP :S	ISP :S	ISPR :S	LF :S	LFA :S
1986	150.873	330.843	3.63136	403.200	1269.10
1987	154.645	343.856	3.93329	409.767	1289.02
1988	157.738	356.547	3.69083	418.966	1320.28
1989	161.681	369.864	3.73513	430.715	1360.18
1990	165.723	384.602	3.98457	445.207	1406.30
1991	170.695	401.853	4.48553	463.227	1466.05

ID	M :S	MA :S	MC :S	ME :S	MIGINA :S
1986	325.299	131.670	186.079	21.7527	70.0245
1987	300.110	352.048	469.269	20.8278	75.0152
1988	284.365	734.484	956.035	20.2518	70.1282
1989	274.483	946.622	1219.62	19.9130	70.7401
1990	268.112	942.927	1212.41	19.6952	75.1341
1991	263.990	996.070	1278.57	19.5541	89.0315

ID	MIGINE :S	MIGNA :S	MIGNE :S	MS :S	NC :S
1986	25.1250	-12.3055	-1.86457	124.290	311.420
1987	27.0869	-2.82944	-.160281	718.093	482.778
1988	27.1412	6.28680	1.63877	1127.22	666.406
1989	28.1828	15.5832	3.67337	1148.50	730.400
1990	29.9053	24.5926	5.85385	1090.19	824.218
1991	33.2898	35.4129	8.56467	1398.37	923.478

ID	NCEP :S	NHP :S	NHPR :S	POPA :S	POPE :S
1986	2342.46	120.458	8.03481	2364.88	702.642
1987	1857.02	126.061	4.65136	2390.43	710.563
1988	1546.07	131.528	4.33657	2425.40	721.544
1989	1346.83	140.523	6.83908	2470.09	735.808
1990	1219.21	151.851	8.06104	2524.32	753.468
1991	1137.31	167.315	10.1832	2590.03	775.378

ID	PR :S	PRA :S	PRDC :S	PRDF :S	PRDM :S
1986	71.7095	72.1243	28.1538	32.6666	15.5252
1987	72.0469	72.2332	23.8187	32.8560	15.6302
1988	72.5334	72.6979	25.2297	33.0293	15.6185
1989	73.1342	73.2764	26.0867	33.2263	14.8189
1990	73.8747	73.7875	26.8606	33.4686	14.2803
1991	74.8073	74.5458	27.5991	33.7631	13.9365

ID	PRDTT :S	RIR :S	RNH :S	RPDY :S	RPY :S
1986	27.7154	7.36000	97.0993	4361.90	13075.8
1987	28.4007	6.72474	98.3931	4413.03	13240.2
1988	27.7914	6.37352	99.0674	4469.10	13420.4
1989	27.3177	6.23870	102.252	4531.50	13621.0
1990	27.0349	6.19781	106.704	4598.52	13838.4
1991	26.9050	5.64256	113.203	4677.05	14088.9

ID	RPYR :S	RSALE :S	RSALE81 :S	S :S	SA :S
1986	.198305	5640.36	4399.55	830.426	1945.55
1987	1.25695	5932.70	4480.82	808.682	1811.71
1988	1.36123	6228.60	4539.68	803.315	1805.31
1989	1.49456	6621.06	4662.02	810.123	1988.95
1990	1.58145	7053.21	4795.95	826.265	2058.57
1991	1.82448	7630.99	4996.09	850.838	2092.76

ID	SC :S	SE :S	SI :S	SS :S	T :S
1986	1972.96	102.027	80.4017	1817.93	245.537
1987	1798.79	103.985	67.4803	1571.63	241.014
1988	1790.33	106.615	52.5030	1848.50	238.360
1989	2029.31	109.744	92.8693	1974.73	236.948
1990	2119.84	113.256	154.133	1997.14	236.377
1991	2164.18	117.114	225.555	2055.03	236.412

ID	TA :S	TC :S	TE :S	TEMP :S	TO :S
1986	2077.22	2159.03	49.1228	228.047	11211.9
1987	2163.76	2268.06	50.2117	232.252	11770.5
1988	2539.79	2746.37	51.3443	236.896	12401.4
1989	2935.57	3248.93	52.5061	242.840	13078.0
1990	3001.50	3332.25	53.6875	249.789	13792.2
1991	3088.83	3442.76	54.8831	257.684	14565.3

ID	TOUT :S	TOUTR :S	TS :S	TSO :S	TT :S
1986	2948.90	-1.67030	1942.22	13698.3	750.715
1987	2970.29	.725266	2289.73	14179.1	742.317
1988	3001.04	1.03539	2975.73	14845.5	745.808
1989	3069.95	2.29587	3123.24	15575.9	758.459
1990	3170.71	3.28230	3087.34	16400.1	778.309
1991	3302.03	4.14157	3453.40	17323.6	805.235

ID	TTE :S	UR :S	URA :S	VR :S	VS :S
1986	27.3232	11.9557	9.61366	17.5391	2484.37
1987	27.0124	12.4644	9.81714	16.2734	2408.57
1988	27.1734	12.8576	10.1618	16.0047	2444.10
1989	27.5867	12.8889	10.2512	15.9175	2497.91
1990	28.1901	12.6883	10.1428	16.2954	2607.92
1991	28.9837	12.2251	9.89236	16.9897	2758.34

ID	WAP :S	WAPA :S	WC :S	WF :S	WM :S
1986	562.268	1759.61	653.924	467.411	574.278
1987	568.751	1784.53	672.580	482.683	589.712
1988	577.618	1816.11	695.942	499.571	617.887
1989	588.938	1856.23	731.593	520.125	654.432
1990	602.652	1905.87	772.319	541.436	693.098
1991	619.227	1966.64	820.376	564.505	737.765

ID	WR :S	WRR :S	WS :S	WT :S	WTT :S
1986	440.026	3.51613	364.942	357.007	606.757
1987	457.059	3.87094	382.897	367.496	626.467
1988	474.010	3.70865	395.036	379.540	648.287
1989	491.393	3.66730	416.877	395.375	674.906
1990	510.817	3.95269	439.039	412.406	702.541
1991	533.414	4.42380	463.472	431.489	732.489

APPENDIX V
COMPARISON OF TWO SIMULATED RESULTS

ABSOF :	City Committee	Base	Residual	%Residual
1986	613.659	611.541	2.11767	.003460
1987	558.579	548.370	10.2089	.018276
1988	630.873	607.459	23.4138	.037113
1989	676.596	639.533	37.0623	.054777
1990	714.207	664.114	50.0921	.070136
1991	773.054	712.861	60.1931	.077863

APTVR :			Residual	%Residual
1986	4.25629	4.29817	-.041873	-.009838
1987	3.58676	3.78039	-.193628	-.053984
1988	3.55955	4.00119	-.441641	-.124072
1989	3.79832	4.48581	-.687482	-.180996
1990	3.95908	4.80109	-.842014	-.212679
1991	3.82678	4.63310	-.806318	-.210703

BPT :			Residual	%Residual
1986	547.109	537.644	9.46527	.017300
1987	641.172	596.751	44.4218	.069282
1988	789.174	686.968	102.205	.129509
1989	953.422	787.391	166.031	.174142
1990	1139.29	908.748	230.543	.202357
1991	1381.98	1101.36	280.615	.203063

BPTR :			Residual	%Residual
1986	426.752	419.418	7.33392	.017185
1987	484.262	450.995	33.2671	.068696
1988	575.185	501.838	73.3471	.127519
1989	671.324	557.875	113.448	.168992
1990	774.681	625.916	148.764	.192033
1991	904.799	736.713	168.086	.185771

CPI :			Residual	%Residual
1986	128.203	128.188	.015014	1.17E-4
1987	132.402	132.318	.083267	6.28E-4
1988	137.203	136.890	.313018	.002281
1989	142.021	141.140	.880218	.006197
1990	147.066	145.186	1.87908	.012777
1991	152.739	149.497	3.24174	.021224

CPIR :	City Committee	Base	Residual	%Residual
1986	3.13999	3.12791	.012079	.003846
1987	3.27525	3.22239	.052860	.016139
1988	3.62647	3.45512	.171352	.047250
1989	3.51128	3.10497	.406316	.115717
1990	3.55219	2.86663	.685558	.192996
1991	3.85742	2.96879	.888627	.230368

EMPA :			Residual	%Residual
1986	1147.10	1144.83	2.27148	.001980
1987	1162.47	1152.50	9.97717	.008582
1988	1186.11	1164.06	22.0473	.018587
1989	1220.74	1185.18	35.5634	.029132
1990	1263.66	1213.63	50.0283	.039589
1991	1321.02	1259.05	61.9714	.046911

EMPE :			Residual	%Residual
1986	354.994	354.240	.754425	.002125
1987	358.692	355.310	3.38217	.009429
1988	365.097	357.521	7.57568	.020749
1989	375.200	362.974	12.2254	.032583
1990	388.718	371.699	17.0190	.043782
1991	406.597	385.825	20.7718	.051087

GDP :			Residual	%Residual
1986	14.3329	14.2918	.041101	.002867
1987	14.6438	14.4787	.165130	.011276
1988	15.0264	14.6927	.333679	.022206
1989	15.5009	14.9964	.504452	.032543
1990	16.0600	15.3718	.688244	.042854
1991	16.7849	15.9625	.822380	.048995

GDPIP :			Residual	%Residual
1986	450.643	450.618	.024505	5.43E-5
1987	469.170	468.875	.295013	6.28E-4
1988	488.775	487.377	1.39712	.002858
1989	508.479	504.533	3.94610	.007760
1990	529.631	521.528	8.10302	.015299
1991	553.625	540.010	13.6148	.024592

GDPR :	City Committee	Base	Residual	%Residual
1986	-.631604	-.916556	.284951	-.451155
1987	2.16969	1.30809	.861594	.397104
1988	2.61267	1.47836	1.13431	.434157
1989	3.15750	2.06691	1.09058	.345395
1990	3.60699	2.50275	1.10423	.306137
1991	4.51360	3.84309	.670516	.148554

LFA :	City Committee	Base	Residual	%Residual
1986	1269.10	1267.60	1.50341	.001184
1987	1289.02	1282.21	6.80993	.005283
1988	1320.28	1304.54	15.7329	.011916
1989	1360.18	1333.33	26.8525	.019741
1990	1406.30	1366.35	39.9505	.028408
1991	1466.05	1413.48	52.5728	.035860

GNP :			Residual	%Residual
1986	150.873	150.873	0.00000	0.00000
1987	154.645	154.645	0.00000	0.00000
1988	157.738	157.738	0.00000	0.00000
1989	161.681	161.681	0.00000	0.00000
1990	165.723	165.723	0.00000	0.00000
1991	170.695	170.695	0.00000	0.00000

MA :			Residual	%Residual
1986	131.670	130.227	1.44299	.010959
1987	352.048	339.400	12.6477	.035926
1988	734.484	673.929	60.5549	.082445
1989	946.619	763.791	182.828	.193138
1990	942.924	573.099	369.824	.392210
1991	998.069	441.458	554.610	.556799

ISP :			Residual	%Residual
1986	330.843	330.803	.039337	1.18E-4
1987	343.856	343.439	.417114	.001213
1988	356.547	354.905	1.64172	.004604
1989	369.864	365.897	3.96713	.010725
1990	384.602	377.317	7.28506	.018941
1991	401.853	390.508	11.3455	.028233

MC :			Residual	%Residual
1986	186.079	184.230	1.84887	.009935
1987	469.269	453.227	16.0417	.034184
1988	956.034	879.578	76.4567	.079972
1989	1219.61	989.258	230.357	.188877
1990	1212.41	747.147	465.265	.383751
1991	1278.57	581.670	696.901	.545062

ISPR :			Residual	%Residual
1986	3.63136	3.61904	.012321	.003393
1987	3.93329	3.81956	.113732	.028915
1988	3.69083	3.33874	.352089	.095395
1989	3.73511	3.09717	.637941	.170795
1990	3.98457	3.12098	.863591	.216733
1991	4.48552	3.49597	.989549	.220609

MIGINA :			Residual	%Residual
1986	70.0244	67.6389	2.38556	.034067
1987	75.0150	66.0638	8.95121	.119325
1988	70.1282	53.6950	16.4332	.234331
1989	70.7401	48.4528	22.2872	.315057
1990	75.1341	47.8480	27.2860	.363164
1991	89.0316	61.9371	27.0945	.304324

LF :			Residual	%Residual
1986	403.200	402.762	.437835	.001085
1987	409.767	407.665	2.10217	.005130
1988	418.966	413.905	5.06176	.012081
1989	430.715	421.946	8.76907	.020359
1990	445.207	432.211	12.9959	.029190
1991	463.227	446.229	16.9974	.036693

MIGINE :			Residual	%Residual
1986	25.1250	24.6680	.457042	.018190
1987	27.0869	25.4103	1.67656	.061895
1988	27.1412	24.1326	3.00860	.110850
1989	28.1828	24.1280	4.05473	.143872
1990	29.9053	24.8759	5.02936	.168176
1991	33.2898	28.1689	5.12089	.153827

MIGNA :	City Committee	Base	Residual	%Residual
1986	-12.3056	-13.5694	1.26376	-.102697
1987	-2.82948	-7.60441	4.77493	-1.68756
1988	6.28680	-2.34751	8.63432	1.37340
1989	15.5831	4.23011	11.3530	.728546
1990	24.5926	11.1271	13.4654	.547539
1991	35.4129	22.2767	13.1361	.370941

MIGNE :			Residual	%Residual
1986	-1.86459	-2.10651	.241922	-.129745
1987	-.160292	-1.10413	.943841	-5.88825
1988	1.63877	-.149689	1.78846	1.09134
1989	3.67336	1.19495	2.47841	.674697
1990	5.85385	2.77324	3.08060	.526253
1991	8.56467	5.32594	3.23872	.378149

MS :			Residual	%Residual
1986	124.290	119.238	5.05163	.040643
1987	718.093	682.099	35.9945	.050125
1988	1127.22	970.574	156.646	.138966
1989	1148.50	755.354	393.145	.342311
1990	1090.19	432.887	657.309	.602927
1991	1398.36	543.883	854.485	.611058

NC :			Residual	%Residual
1986				
1987	311.420	305.088	6.33111	.020329
1988	482.778	458.244	24.5338	.050818
1989	666.406	620.198	46.2084	.069339
1990	730.399	666.593	63.8064	.087358
1991	824.218	743.733	80.4852	.097650
	923.478	836.222	87.2559	.094488

NHP :			Residual	%Residual
1986				
1987	120.458	119.717	.741577	.006156
1988	126.061	122.810	3.25136	.025791
1989	131.528	124.363	7.16526	.054476
1990	140.523	129.124	11.3994	.081121
1991	151.851	136.235	15.6157	.102835
	167.315	148.690	18.6246	.111315

NHPR :	City Committee	Base	Residual	%Residual
1986	8.03480	7.36970	.665092	.082776
1987	4.65131	2.58369	2.06761	.444523
1988	4.33661	1.26447	3.07213	.708418
1989	6.83906	3.82837	3.01068	.440219
1990	8.06106	5.50743	2.55363	.316785
1991	10.1832	9.14191	1.04135	.102261

POPA :			Residual	%Residual
1986	2364.88	2363.61	1.26367	5.34E-4
1987	2390.43	2384.37	6.05371	.002532
1988	2425.40	2410.64	14.7605	.006085
1989	2470.09	2443.80	26.2907	.010643
1990	2524.32	2484.25	40.0715	.015874
1991	2590.03	2536.34	53.6884	.020728

POPE			Residual	%Residual
1986	702.642	702.252	.389587	5.54E-4
1987	710.563	708.678	1.88464	.002652
1988	721.544	716.890	4.65411	.006450
1989	735.808	727.384	8.42321	.011447
1990	753.468	740.382	13.0856	.017367
1991	775.378	757.433	17.9447	.023143

PR :			Residual	%Residual
1986	71.7095	71.6725	.036987	5.15E-4
1987	72.0469	71.8713	.175552	.002436
1988	72.5334	72.1243	.409095	.005640
1989	73.1342	72.4644	.669799	.009158
1990	73.8747	72.9444	.930244	.012592
1991	74.8073	73.6732	1.13404	.015159

PRA :			Residual	%Residual
1986	72.1243	72.0864	.037811	5.24E-4
1987	72.2332	72.0850	.148185	.002051
1988	72.6979	72.4077	.290267	.003992
1989	73.2764	72.8481	.428306	.005845
1990	73.7875	73.2031	.584373	.007919
1991	74.5458	73.8398	.706016	.009470

RIR :	City Committee	Base	Residual	%Residual
1986	7.36000	7.37208	-.012079	-.001641
1987	6.72474	6.77760	-.052860	-.007860
1988	6.37352	6.54487	-.171353	-.026885
1989	6.23871	6.64502	-.406316	-.065128
1990	6.19781	6.88336	-.685558	-.110613
1991	5.64257	6.53120	-.888628	-.157486

RSALE :	City Committee	Base	Residual	%Residual
1986	5640.35	5621.85	18.5034	.003280
1987	5932.70	5851.94	80.7583	.013612
1988	6228.60	6051.18	177.427	.028485
1989	6621.06	6332.80	288.258	.043536
1990	7053.21	6639.12	414.086	.058708
1991	7630.98	7106.93	524.052	.068674

RNH :			Residual	%Residual
1986	97.0993	96.5128	.586471	.006039
1987	98.3931	95.9156	2.47742	.025178
1988	99.0673	93.8846	5.18269	.052314
1989	102.252	94.5434	7.70888	.075390
1990	106.704	96.9705	9.73403	.091224
1991	113.203	102.784	10.4197	.092044

RSALE81 :			Residual	%Residual
1986	4399.55	4385.63	13.9194	.003163
1987	4480.82	4422.61	58.2133	.012991
1988	4539.68	4420.45	119.232	.026264
1989	4662.02	4486.86	175.159	.037571
1990	4795.95	4572.81	223.137	.046526
1991	4996.09	4753.89	242.206	.048479

RPDY :			Residual	%Residual
1986	4361.90	4357.49	4.41308	.001011
1987	4413.03	4395.44	17.5908	.003986
1988	4469.10	4434.61	34.4965	.007718
1989	4531.50	4481.41	50.0888	.011053
1990	4598.52	4533.21	65.3071	.014201
1991	4677.05	4603.82	73.2368	.015658

SA :			Residual	%Residual
1986	1945.55	1945.54	.011840	6.08E-6
1987	1811.71	1810.56	1.15234	6.36E-4
1988	1805.31	1792.49	12.8208	.007101
1989	1988.95	1932.53	56.4173	.028365
1990	2058.57	1917.26	141.306	.068642
1991	2092.76	1852.09	240.665	.114999

RPY :			Residual	%Residual
1986	13075.8	13061.6	14.1855	.001084
1987	13240.2	13183.6	56.5439	.004270
1988	13420.4	13309.5	110.885	.008262
1989	13621.0	13460.0	161.006	.011820
1990	13836.4	13626.5	209.923	.015171
1991	14088.9	13853.4	235.410	.016708

SC :			Residual	%Residual
1986	1972.96	1972.96	0.00000	0.00000
1987	1798.79	1797.35	1.44091	8.01E-4
1988	1790.33	1773.75	16.5837	.009262
1989	2029.31	1956.00	73.3101	.036125
1990	2119.83	1936.03	183.807	.086708
1991	2164.18	1851.01	313.173	.144707

RPYR :			Residual	%Residual
1986	.198298	.089596	.108701	.548171
1987	1.25695	.934029	.322929	.256913
1988	1.36123	.954881	.406351	.298517
1989	1.49455	1.13042	.364127	.243636
1990	1.58145	1.23695	.344506	.217841
1991	1.82448	1.66556	.158927	.087108

SI :			Residual	%Residual
1986	80.4017	80.4135	-.011840	-1.47E-4
1987	67.4803	67.2036	.276733	.004100
1988	52.5030	48.4633	4.03967	.076941
1989	92.8691	71.9366	20.9325	.225397
1990	154.132	90.6989	63.4333	.411551
1991	225.554	89.6131	135.941	.602698

SS :	City Committee	Base	Residual	%Residual
1986	1817.93	1817.93	0.00000	0.00000
1987	1571.63	1568.88	2.74694	.001747
1988	1848.50	1820.16	28.3474	.015335
1989	1974.73	1868.70	106.036	.053696
1990	1997.14	1772.87	224.269	.112294
1991	2055.03	1724.78	330.244	.160700

TSO :	City Committee	Base	Residual	%Residual
1986	13696.3	13690.0	6.33105	4.62E-4
1987	14179.1	14148.2	30.8652	.002176
1988	14845.5	14768.4	77.0732	.005191
1989	15575.9	15435.0	140.879	.009044
1990	16400.1	16178.8	221.364	.013497
1991	17323.6	17015.0	308.621	.017815

TA :			Residual	%Residual
1986	2077.22	2075.77	1.45483	7.00E-4
1987	2163.76	2149.96	13.8000	.006377
1988	2539.79	2466.42	73.3757	.028890
1989	2935.57	2696.32	239.246	.081498
1990	3001.50	2490.36	511.130	.170291
1991	3088.83	2293.55	795.276	.257468

UR :			Residual	%Residual
1986	11.9557	12.0473	-.091601	-.007661
1987	12.4644	12.8427	-.378257	-.030346
1988	12.8576	13.6222	-.764605	-.059466
1989	12.8889	13.9759	-1.08701	-.084337
1990	12.6883	14.0007	-1.31235	-.103429
1991	12.2251	13.5366	-1.31151	-.107280

TC :			Residual	%Residual
1986	2159.03	2157.19	1.84887	8.56E-4
1987	2268.08	2250.58	17.4826	.007708
1988	2746.37	2653.33	93.0405	.033877
1989	3248.93	2945.26	303.667	.093466
1990	3332.25	2683.17	649.073	.194785
1991	3442.75	2432.68	1010.07	.293391

URA :			Residual	%Residual
1986	9.61366	9.68566	-.071993	-.007488
1987	9.81715	10.1163	-.299152	-.030472
1988	10.1618	10.7683	-.606585	-.059692
1989	10.2512	11.1110	-.859775	-.083870
1990	10.1428	11.1769	-1.03413	-.101957
1991	9.89235	10.9252	-1.03285	-.104409

TO :			Residual	%Residual
1986	11211.9	11209.8	2.11816	1.88E-4
1987	11770.5	11758.2	12.3271	.001047
1988	12401.4	12365.7	35.7412	.002882
1989	13078.0	13005.2	72.8037	.005566
1990	13792.2	13669.3	122.895	.008910
1991	14565.3	14382.2	183.088	.012570

VR :			Residual	%Residual
1986	17.5391	17.5050	.034133	.001946
1987	16.2734	16.1244	.148998	.009155
1988	16.0047	15.6767	.328009	.020494
1989	15.9175	15.3863	.531152	.033369
1990	16.2954	15.5413	.754114	.046277
1991	16.9897	16.0505	.939199	.055280

TS :			Residual	%Residual
1986	1942.22	1937.17	5.05163	.002600
1987	2289.72	2250.98	38.7414	.016919
1988	2975.72	2790.73	184.993	.062167
1989	3123.23	2624.05	499.181	.159828
1990	3087.34	2205.76	881.579	.285546
1991	3453.40	2268.67	1184.72	.343061

VS :			Residual	%Residual
1986	2484.37	2480.16	4.21289	.001695
1987	2408.57	2390.03	18.5380	.007696
1988	2444.10	2402.77	41.3320	.016910
1989	2497.91	2429.83	68.0761	.027253
1990	2607.92	2509.45	98.4687	.037757
1991	2758.34	2632.81	125.532	.045509

WAP :	City Committee	Base	Residual	%Residual
1986	562.268	561.947	.320739	5.70E-4
1987	568.751	567.215	1.53570	.002700
1988	577.618	573.876	3.74182	.006478
1989	588.938	582.280	6.65759	.011304
1990	602.652	592.521	10.1306	.016810
1991	619.227	605.687	13.5396	.021865

WAPA :			Residual	%Residual
1986	1759.61	1758.45	1.16272	6.60E-4
1987	1784.53	1778.75	5.77856	.003238
1988	1816.11	1801.67	14.4477	.007955
1989	1856.23	1830.29	25.9473	.013978
1990	1905.87	1866.51	39.3604	.020652
1991	1966.64	1914.25	52.3945	.026641

WR :			Residual	%Residual
1986	440.026	439.968	.058105	1.32E-4
1987	457.059	456.443	.615966	.001347
1988	474.010	471.586	2.42425	.005114
1989	491.393	485.535	5.85815	.011921
1990	510.817	500.059	10.7578	.021059
1991	533.414	516.660	16.7536	.031408

WRR :			Residual	%Residual
1986	3.51613	3.50246	.013669	.003887
1987	3.87094	3.74465	.126284	.032623
1988	3.70864	3.31748	.391164	.105473
1989	3.66730	2.95799	.709307	.193413
1990	3.95269	2.99130	.961396	.243225
1991	4.42379	3.31989	1.10389	.249536

APPENDIX VI
HISTORICAL DATA, 1971-1985

+ ID	FWAP	IR	NEP	RGNP	TIME
1971A	49.5000	6.48000	.000000	NA	1971.00
1972A	49.5000	6.00000	.000000	NA	1972.00
1973A	49.6000	7.65000	.000000	NA	1973.00
1974A	49.6000	10.7500	.000000	NA	1974.00
1975A	49.7000	9.42000	.000000	NA	1975.00
1976A	49.7000	10.0400	.000000	NA	1976.00
1977A	49.7000	8.50000	.000000	NA	1977.00
1978A	49.8000	9.69000	.000000	NA	1978.00
1979A	49.3000	12.9000	.000000	NA	1979.00
1980A	49.2000	19.2500	.000000	NA	1980.00
1981A	49.1000	19.2900	.000000	NA	1981.00
1982A	49.1000	15.8100	1.00000	NA	1982.00
1983A	49.1000	11.2000	1.00000	NA	1983.00
1984A	49.3000	12.1000	1.00000	NA	1984.00
1985A	49.8000	10.7000	.000000	NA	1985.00

+ ID	URC	WCM	WCS	WOP	WRC
1971A	6.20000	143.990	98.5700	2.29000	137.640
1972A	6.20000	156.100	107.320	2.48000	150.000
1973A	5.50000	167.480	114.530	5.04000	166.000
1974A	5.30000	185.620	126.080	11.2500	178.090
1975A	6.90000	213.430	143.680	11.2500	203.340
1976A	7.10000	241.190	160.490	11.5000	228.030
1977A	8.10000	266.040	171.280	12.7000	249.950
1978A	8.30000	285.670	180.000	15.0000	265.370
1979A	7.40000	311.190	193.300	28.7500	288.250
1980A	7.50000	342.190	211.170	38.0000	317.390
1981A	7.50000	383.750	234.850	34.0000	355.280
1982A	11.0000	424.300	260.630	34.0000	390.790
1983A	11.9000	442.220	258.000	29.0000	390.510
1984A	11.3000	469.180	256.000	29.0000	405.130
1985A	10.5000	470.000	250.000	28.0000	450.000

+ ID	ABSOF	APTVR	BPT	BPTR	CE
1971A	853.500	NA	200.144	200.144	10.0993
1972A	30.0000	7.60000	191.016	174.444	10.8664
1973A	208.500	5.30000	200.673	183.815	11.6334
1974A	631.700	.800000	266.684	197.837	11.8891
1975A	477.100	.300000	341.120	234.603	11.7612
1976A	602.150	1.000000E-02	484.658	289.173	13.9345
1977A	798.200	.100000	629.570	341.045	14.5737
1978A	588.150	.800000	746.226	370.888	14.9572
1979A	643.900	1.90000	798.171	360.023	19.1759
1980A	806.980	1.10000	873.200	376.542	19.0481
1981A	1040.26	1.10000	1157.04	450.560	20.4543
1982A	-317.774	4.00000	802.627	294.110	18.4089
1983A	85.1240	8.50000	583.243	192.299	15.5964
1984A	160.252	10.4000	333.930	106.482	13.5510
1985A	465.371	5.90000	481.420	151.724	13.0000

+ ID	CONST	CPI	CPIR	EMPA	EMPE
1971A	199.732	42.1000	4.00000	643.000	199.000
1972A	227.642	43.8000	4.50000	688.000	193.000
1973A	240.458	47.6000	8.70000	718.000	208.000
1974A	273.434	52.1000	9.50000	754.000	233.000
1975A	325.884	57.7000	10.7000	788.000	268.000
1976A	279.467	62.3000	8.00000	837.000	278.000
1977A	298.020	68.0000	9.10000	868.000	270.000
1978A	378.982	74.1000	9.00000	915.000	290.000
1979A	477.572	80.7000	8.90000	1007.00	310.000
1980A	499.273	88.9000	10.2000	1078.00	332.000
1981A	544.603	100.000	12.5000	1152.00	356.000
1982A	532.742	110.800	10.8000	1132.00	347.000
1983A	423.746	117.200	5.80000	1115.00	332.000
1984A	366.409	120.400	2.70000	1114.00	328.000
1985A	366.000	124.300	3.20000	1123.00	349.000

+ ID	F	FE	GDP	GDPIP	GDPR
1971A	259.277	7.16138	7.86600	100.000	6.70000
1972A	254.001	7.29159	8.45700	105.300	7.50000
1973A	300.879	8.20303	9.29600	119.600	9.90000
1974A	301.842	9.24469	9.68800	161.400	4.40000
1975A	321.927	9.89572	10.1930	184.000	5.20000
1976A	312.876	10.9374	10.5810	203.700	3.80000
1977A	352.767	11.9790	11.1510	218.400	5.40000
1978A	387.399	13.1509	11.9520	236.500	7.20000
1979A	415.009	14.1928	13.2140	265.000	10.6000
1980A	452.889	15.3644	13.8590	302.200	4.90000
1981A	471.557	16.1457	14.5390	337.000	4.90000
1982A	514.196	16.4061	13.8740	381.000	-4.60000
1983A	509.521	15.7550	13.5000	407.800	-2.70000
1984A	492.718	15.1040	13.7300	421.600	1.70000
1985A	490.000	15.0000	14.4240	436.400	5.10000

+ ID	GNP	ISP	LF	LFA	M
1971A	94.4500	100.000	210.000	682.000	247.231
1972A	100.248	104.500	204.000	708.000	259.803
1973A	107.812	116.100	218.000	741.000	275.014
1974A	111.678	138.100	241.000	781.000	285.963
1975A	113.005	153.700	279.000	822.000	316.937
1976A	119.249	161.600	290.000	871.000	325.945
1977A	121.762	174.300	282.000	909.000	333.425
1978A	126.191	190.400	305.000	960.000	372.472
1979A	129.850	217.900	322.000	1048.00	394.649
1980A	130.467	247.200	347.000	1120.00	380.095
1981A	136.114	272.400	371.000	1198.00	426.634
1982A	130.069	288.800	377.000	1227.00	382.779
1983A	134.361	298.800	377.000	1249.00	366.516
1984A	141.097	310.900	381.000	1254.00	341.556
1985A	146.479	319.250	397.000	1249.00	340.000

+ ID	MA	MC	ME	MIGNA	MIGNE
1971A	NA	NA	18.1528	13.5490	-759.000
1972A	8325.00	5987.00	18.6408	8.95200	-4.43400
1973A	5712.00	5483.00	19.9095	9.97000	-1.84800
1974A	2931.00	2808.00	21.1783	9.43400	1.22100
1975A	1467.00	1470.00	21.2759	38.6000	5.05400
1976A	2365.00	2364.00	21.5687	51.7000	4.69800
1977A	6419.00	7221.00	21.7639	48.9000	1.42700
1978A	8298.00	9090.00	22.5446	48.4000	8.05600
1979A	6769.00	7651.00	23.8134	57.1000	8.87400
1980A	5147.00	4590.00	24.4965	66.6000	9.28200
1981A	5455.00	5282.00	25.5701	56.1000	13.6250
1982A	6947.00	7294.00	22.4470	14.7000	1.11500
1983A	6146.00	5271.00	22.5446	-22.7000	-3.61000
1984A	1584.00	1198.00	22.9350	-32.2000	-4.00000
1985A	407.000	295.000	22.0000	-8.40000	-1.70000

+ ID	MIGOTA	MS	NC
1971A	NA	NA	794.000
1972A	NA	5113.00	.000000
1973A	NA	2409.00	205.000
1974A	NA	1412.00	718.000
1975A	NA	2951.00	424.590
1976A	53.2880	6536.00	666.000
1977A	80.1650	7444.00	1369.00
1978A	103.570	9234.00	33.0000
1979A	92.4050	5544.00	433.500
1980A	90.5700	5255.00	1289.72
1981A	112.100	6471.00	485.000
1982A	70.9000	7300.00	932.053
1983A	98.4000	2053.00	1830.52
1984A	109.500	127.000	-289.239
1985A	82.7000	80.0000	400.551

+ ID	NCEP	NHP	POPA	POPE	PR
1971A	1129.00	41.3000	1628.00	496.000	62.2000
t1972A	1142.00	44.4000	1657.00	505.000	62.1000
1973A	1342.00	53.9000	1690.00	515.000	63.1000
1974A	1703.00	70.2000	1722.00	526.000	63.5000
1975A	1861.00	83.5000	1778.00	537.000	68.2000
1976A	2361.00	100.000	1838.00	556.000	69.2000
1977A	2748.00	106.900	1913.00	568.000	67.7000
1978A	3226.00	114.300	1983.00	580.000	69.5000
1979A	3754.00	123.000	2053.00	599.000	71.2000
1980A	4111.00	132.700	2141.00	619.000	72.0000
1981A	3809.00	139.900	2237.00	657.000	73.9000
1982A	3377.00	137.200	2319.00	681.000	72.8000
1983A	2952.00	126.500	2347.00	691.000	71.4000
1984A	3160.00	118.800	2341.00	688.000	72.9600
1985A	3100.00	111.500	2349.00	692.000	72.0000

+ ID	PRA	PRDC	PRDF	PRDM	PRDTT
1971A	63.1000	18.0000	35.0000	13.0000	20.0000
1972A	63.7000	18.3800	35.5600	13.2600	20.1900
1973A	64.7000	19.5700	30.9600	13.0500	22.4000
1974A	65.6000	20.2300	32.5500	12.9900	21.8300
1975A	66.1000	23.2500	30.5000	13.4400	21.9400
1976A	66.9000	23.3900	29.4300	14.6900	21.2400
1977A	67.0000	19.1800	26.1200	14.9800	22.8900
1978A	68.2000	19.9200	26.8200	14.7900	22.7300
1979A	69.7000	19.7600	27.3000	15.6400	23.3000
1980A	70.9000	25.0700	27.0100	16.1100	24.1200
1981A	72.3000	24.4100	28.0500	14.8600	25.4500
1982A	71.4000	29.5800	28.7400	19.0100	27.1500
1983A	71.6000	34.1600	32.6400	16.0900	27.1800
1984A	72.1000	31.2700	33.7300	15.9800	27.6000
1985A	71.9000	31.2700	33.7300	15.9800	27.6000

+ ID	RIR	RNH	RPDY	RPY	RSALE
1971A	3.60000	100.000	2772.00	8124.00	1007.80
1972A	1.30000	104.500	2979.00	8648.00	1152.98
1973A	-.100000	117.800	3208.00	9288.00	1352.33
1974A	.200000	139.100	3412.00	10063.0	1714.40
1975A	-1.40000	149.300	3571.00	10737.0	2094.20
1976A	2.50000	165.600	3695.00	11054.0	2300.98
1977A	.600000	162.200	3748.00	11103.0	2720.00
1978A	.900000	159.200	3899.00	11316.0	3173.55
1979A	3.70000	157.300	4101.00	11979.0	3741.79
1980A	4.10000	154.000	4237.00	12424.0	4037.98
1981A	6.80000	144.400	4579.00	13040.0	4491.90
1982A	5.00000	127.800	4239.00	12865.0	4405.10
1983A	5.40000	111.400	4095.00	12521.0	4079.20
1984A	7.70000	101.900	4173.00	12710.0	4699.33
1985A	7.50000	92.7000	4151.00	13050.0	5314.64

+ ID	RSALE81	S	SA	SC	SE
1971A	2405.00	407.107	NA	NA	41.9739
1972A	2632.00	427.164	1504.00	1497.00	42.8670
1973A	2841.00	460.041	1665.00	626.000	46.1415
1974A	3290.00	466.548	2841.00	2902.00	50.0115
1975A	3629.00	542.498	2062.00	2034.00	53.5837
1976A	3693.00	620.800	4300.00	4299.00	61.9190
1977A	4000.00	677.504	3733.00	3759.00	66.9796
1978A	4283.00	757.604	4101.00	4484.00	75.3149
1979A	4637.00	807.182	4117.00	4990.00	77.1010
1980A	4542.00	850.644	3640.00	3586.00	80.6733
1981A	4492.00	873.784	4305.00	4359.00	86.6270
1982A	3976.00	818.960	2852.00	2256.00	84.8409
1983A	3481.00	910.841	3010.00	2473.00	94.9623
1984A	3903.00	925.605	2640.00	2540.00	100.916
1985A	4279.00	925.000	1638.00	1596.00	100.000

+ ID	SI	SS	T	TA	TC
1971A	NA	NA	300.814	NA	NA
1972A	146.000	1651.00	320.307	7829.00	7484.00
1973A	107.000	2313.00	357.156	7377.00	7109.00
1974A	168.000	2355.00	404.618	5772.00	5510.00
1975A	140.000	3996.00	441.230	3529.00	3504.00
1976A	139.000	3723.00	597.593	6665.00	6663.00
1977A	189.000	3207.00	500.163	10152.0	10980.0
1978A	429.000	5434.00	543.386	12399.0	13574.0
1979A	1302.00	4138.00	652.614	10886.0	12641.0
1980A	1248.00	3191.00	649.973	8787.00	8176.00
1981A	1302.00	4046.00	661.124	9760.00	9641.00
1982A	727.000	1812.00	568.674	9799.00	9550.00
1983A	190.000	3003.00	576.875	9156.00	7744.00
1984A	93.0000	1750.00	570.795	4224.00	3738.00
1985A	53.0000	1890.00	570.000	2045.00	1891.00

+ ID	TE	TO	TOUT	TS	TSO
1971A	31.7939	2653.99	1758.00	NA	2724.00
1972A	33.8407	3477.99	1883.00	6764.00	3517.99
1973A	36.1605	3481.49	2056.00	4722.00	3517.99
1974A	39.1625	4318.19	2188.00	3767.00	4440.99
1975A	40.5270	4795.19	2416.00	6947.00	4865.48
1976A	44.4842	5397.34	2658.00	10259.0	5531.48
1977A	43.6655	6195.54	2720.00	10651.0	6900.48
1978A	46.9404	6783.69	3045.00	14668.0	7230.48
1979A	48.7143	7427.59	3422.00	9682.00	7663.98
1980A	52.1256	8166.29	3567.00	8446.00	8953.70
1981A	54.3089	9206.55	3776.00	10517.0	9438.70
1982A	52.6715	8888.78	3564.00	9112.00	10370.9
1983A	53.6266	9972.71	3566.00	5056.00	13253.6
1984A	52.5350	10133.0	3473.00	1877.00	12984.4
1985A	52.0000	10598.3	2999.00	1970.00	13384.9

+ ID	TT	TTE	UR	URA	VR
1971A	344.118	16.3769	5.20000	5.70000	2.50000
1972A	394.108	17.0409	5.10000	5.60000	1.10000
1973A	422.742	17.5941	4.70000	5.30000	1.00000
1974A	456.366	19.3646	3.10000	3.50000	3.40000
1975A	467.673	20.8031	4.00000	4.20000	1.60000
1976A	521.791	22.0203	4.00000	4.00000	2.40000
1977A	558.438	22.7949	4.30000	4.50000	10.2000
1978A	605.900	24.5654	4.70000	4.70000	6.20000
1979A	675.367	26.0039	3.70000	3.90000	3.10000
1980A	734.898	27.9957	4.10000	3.70000	8.70000
1981A	799.231	28.8809	4.10000	3.80000	.500000
1982A	766.884	29.4342	8.00000	7.70000	14.3000
1983A	778.855	28.2170	12.1000	10.8000	24.8000
1984A	776.032	28.2170	14.1000	11.2000	22.0000
1985A	776.000	28.0000	12.2000	10.1000	20.8000

+ ID	VS	WAP	WAPA	WC	WF
1971A	70.0000	341.000	1081.00	175.000	124.340
1972A	40.0000	331.000	1111.00	194.270	133.350
1973A	36.5000	355.000	1145.00	209.900	147.210
1974A	122.800	394.000	1190.00	239.970	164.260
1975A	70.2900	409.000	1244.00	273.160	187.310
1976A	134.140	419.000	1302.00	322.520	199.950
1977A	704.940	417.000	1356.00	353.750	214.310
1978A	446.790	438.000	1409.00	372.710	237.180
1979A	236.390	453.000	1503.00	442.560	261.620
1980A	787.410	481.000	1579.00	484.520	294.680
1981A	232.149	502.000	1657.00	548.620	347.620
1982A	1482.08	518.000	1718.00	603.390	389.970
1983A	3280.93	528.000	1745.00	548.610	415.090
1984A	2851.44	523.000	1740.00	531.210	421.080
1985A	2786.61	552.000	1738.00	NA	NA

+ ID	WM	WR	WS	WT	WTT
1971A	148.360	130.420	87.8100	108.900	156.560
1972A	158.630	142.440	96.9000	116.520	174.030
1973A	171.540	153.080	104.180	128.900	184.530
1974A	188.190	171.300	105.390	143.040	210.260
1975A	221.800	197.740	132.450	165.860	240.790
1976A	252.530	219.030	145.910	180.780	269.230
1977A	273.970	241.090	160.240	199.180	296.300
1978A	298.990	257.650	172.340	211.150	319.380
1979A	330.660	291.120	189.800	231.770	347.680
1980A	369.860	320.540	207.860	250.230	385.380
1981A	418.120	363.310	233.170	283.340	436.600
1982A	470.480	399.800	260.440	297.090	502.010
1983A	485.090	409.810	288.050	312.550	542.490
1984A	463.530	414.710	295.050	318.710	545.060
1985A	NA	425.080	NA	NA	NA